November 20, 1890.

Sir G. GABRIEL STOKES, Bart., President, in the Chair.

In pursuance of the Statutes, notice of the ensuing Anniversary Meeting was given from the Chair.

Sir James Cockle, Mr. A. A. Common, Professor G. Carey Foster, the Rev. Professor Price, and Dr. Rae were by ballot elected Auditors of the Treasurer's accounts on the part of the Society.

The Presents received were laid on the table, and thanks ordered for them.

The following Papers were read:—

I. "On the Determination of the Specific Resistance of Mercury in Absolute Measure." By J. V. JONES, Principal and Professor of Physics in the University College of South Wales and Monmouthshire, Cardiff. Communicated by Professor CLIFTON, F.R.S. Received August 8, 1890.

(Abstract.)

In the hope of paving the way for a more accurate determination of the ohm, the author has for a considerable time been engaged in submitting to the test of experiment certain modifications of the method of Lorenz which occurred to him as likely to lead to increased accuracy and certainty. The experiments have been made in the laboratory of the University College, Cardiff, with apparatus for the most part constructed in the College workshop. Five complete sets of observations were taken in the spring of this year, with the following results for the specific resistance of mercury at 0° C.:—

(i.)	94,103	absolute C.G.S. units.
(ii.)	94,074	,, ,, ,,
(iii.)	94,093	,, ,, ,,
(iv.)	94,045	,, ,, ,,
(v.)	94,021	,, ,, ,,
Mean..	94,067	$\pm$ 10 (probable error).

The result may be otherwise expressed by saying that the ohm is

equal to the resistance of a column of mercury of 1 square mm. sectional area and 106·307 cm. long, the probable error being $\pm 0·012$.

The author does not bring these numbers forward as the best determination possible by the method he has used. He is of opinion that if the apparatus be constructed on a scale a little larger and with a certain perfecting of detail, a single set of observations will give a result accurate to one part in 10,000, and that as a mean of a number of observations we may perhaps aim at the hundred-thousandth if regard is paid to the maintenance of definite temperatures in all parts of the apparatus, and if we can be said to know our length-standards to this degree of accuracy.

The observations were made by the method of Lorenz directly on mercury. The chief variations in the method introduced in the present investigation are as follows :—

(i) The elimination by a system of differential measurements of the errors that have so far attended the use of a mercury column as the measured resistance.

Lorenz himself took for his measured resistance the resistance of a mercury column contained in a glass tube, and the specific resistance was calculated from the dimensions of the column. It is hardly possible, however, that the latter calculation can have been, or is likely to be, achieved with accuracy, however accurately the tube be calibrated. For, on the one hand, if the wires from the disc (the terminal portions of which may be called the electrodes) are led to the ends of the tube, the equi-potential surfaces touched by them are not plane; and, on the other, if they are let into the tube at some distance from the ends, it is difficult to see how the distance between them is to be measured with the requisite accuracy.

These difficulties disappear if, instead of placing the mercury in a tube, it is placed in a long trough, and if, instead of measuring the distance between two electrodes, one electrode is kept fixed while measurement is made of the distance moved through by the other between two equilibrium positions corresponding to two different rates of rotation of the disc. The latter measurement it is easy to make with accuracy, for the movable electrode may be rigidly attached to the movable headstock of a Whitworth measuring machine or some other measuring bank placed parallel to the length of the trough; and the two equilibrium positions may be taken near the middle of the trough so as to avoid danger of curvature in the equipotential surfaces passing through the electrode in its two positions.

Let n_1, n_2 be the rates of rotation of the disc, and let l be the distance between the corresponding equilibrium positions of the movable electrode.

Then $$M\,(n_1 - n_2) = \frac{l}{A}\,\rho,$$

where M = the coefficient of mutual induction of coil and disc;
ρ = the specific resistance of mercury;
A = area of section of the mercury column.

The capillary depression at the sides of the trough would make it a serious task to determine the section of the mercury column by direct measurement to the required degree of accuracy. This difficulty is overcome by a further differential method, viz., by making observations with the mercury at two different heights in the trough.

Let b = the breadth of the trough;
$h_2 - h_1$ = the difference of height of the mercury surface in the two cases; and let
A = the section of the mercury column when the mercury is at the lower position.

Then we have, denoting by dashed letters the new values of the rates of rotation and the distance between the corresponding equilibrium positions—

$$M\,(n_1 - n_2) = \frac{l}{A}\,\rho,$$

and $$M\,(n'_1 - n'_2) = \frac{l}{A + b\,(h_2 - h_1)};$$

whence, eliminating A,

$$\rho = \frac{Mb\,(h_2 - h_1)}{\dfrac{l'}{n'_1 - n'_2} - \dfrac{l}{n_1 - n_2}}.$$

It is assumed in the above formula that the sides of the trough in that part of it traversed by the movable electrode are plane, parallel, and vertical.

The trough used in the experiments described was cut in paraffin wax, contained in a strong casting of iron, with its sides strengthened by outside ribs. The channel is approximately 43·5 inches long by 1·5 inches broad by 3 inches deep. It was first cut by a cutter rotating about 2000 times a minute, attached to the slide rest of the College Whitworth lathe, and subsequently finished by a scraper, attached in similar fashion, which took a very thin cut off sides and bottom. The result of the scraping was a very smooth and highly-finished surface.

(ii) The use of a standard coil with a single layer of wire, the coefficient of mutual induction of the coil and circumference of the disc being calculated by a formula obtained by the direct integration of the expression

$$\iint \frac{ds\ ds}{r} \cos \epsilon$$

for a circle and coaxial helix.

(iii) The use of a new form of contact brush at the disc circumference, which procures greatly increased steadiness in the galvanometer needle.

The brush consists of a single wire of phosphor bronze, perforated by a channel through which a continuous flow of mercury is maintained from a cistern of adjustable height.

Incidentally, a description is given of an accurate method of measuring the vibration frequency of a standard tuning-fork by means of a Bain's electrochemical telegraph receiver.

In conclusion, suggestions are made towards a new determination of the ohm that shall be final for the practical purposes of the electrical engineer.

II. "The Spectroscopic Properties of Dust." By G. D. Liveing, M.A., F.R.S., Professor of Chemistry, and J. Dewar, M.A., F.R.S., Jacksonian Professor, University of Cambridge. Received August 16, 1890.

The suggestion that the auroral spectrum, the principal ray in the spectrum of nebulæ, and other rays of unknown origin, might be due to meteoric dust induced us to investigate the problem whether solid particles of sufficient minuteness would act like gaseous molecules in an electric discharge and become luminous with their characteristic special radiation. The dust we employed was that thrown off from the surface of various electrodes by a disruptive discharge, and it was carried forward into the tube of observation by a more or less rapid current of air or other gas. The arrangement will be best understood from the annexed diagram, which represents a section of the glass vessel which was the principal part of the apparatus. *A* represents a bulb in which were the electrodes *a*, *a* to give the dust, connected by a widish tube *d* with the tube for observation *B*. The end *E* was blown clear, so that the narrow part of *B* could be observed end-on. The electrodes *e*, *e* were of platinum. The tube *g*, passing from *A* to the supply of gas, was fitted with a glass stopcock